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MINERALOGY AND PETROGRAPHY.¹

Petrographical News.—In an argumentative article on the individuality of rocks Lang² proposes to regard as a rock individual the product of a continuous (uninterrupted) rock-forming process. Accordingly he would class interbedded clays, sandstones, and conglomerates deposited from the same body of water by a gradual lessening of its velocity, as a single rock, with clayey, sandy, and conglomeratic facies. In the eruptive group, that is a rock individual which has been forced from the depths of the earth by a single earth-throe. The beginning and end of a rock-forming process thus marks the limitations of a rock individual, even though a second period of similar processes should subsequently give rise to a rock of the same nature as that previously formed. The ideas discussed in the article are of great interest, but the practical advantages to be gained by regarding rocks from the point of view of its author are not immediately perceptible.—Another article of some theoretical interest is Justus Roth's criticism of Rosenbusch's³ recent paper on the chemical nature of eruptive rocks. After giving a short historical review of the attempt to explain the variation in eruptive rocks upon a chemical basis, the author⁴ proceeds to examine critically the views set forth by Rosenbusch. In the first place, he states that ten of the sixty-three rocks whose analyses are quoted by this writer are much altered from their original condition; others are but local in distribution, while of others, again, the analyses are incomplete. He further continues by showing that the fundamental magmas by whose mixture the various types of rocks are regarded as made up, far from giving rise to definite varieties when mingled in definite proportions, may themselves consist of different combinations of different minerals. He then calls attention to what appear to be weak points in Rosenbusch's calculations, and concludes with the statement that there is not yet sufficient knowledge concerning the chemical character of eruptives to warrant the construction of a theory concerning their composition.—Loewinson-Lessing⁵ has attacked the chemistry of the eruptive rocks in a little different way from Rosenbusch. He compares the relations between the bases and the acid in a rock, and calls

¹ Edited by Dr. W. S. Bayley, Colby University, Waterville, Maine.

² *Miner u. Petrog. Mitth.*, XI., p. 467.

³ *AMERICAN NATURALIST*, 1890, p. 1071.

⁴ *Zeits. d. deuts. geol. Ges.*, 1891, p. 1.

⁵ *Bull. Soc. Belge de Géol.*, etc., IV., 1890, p. 1.

those rocks acid that contain an excess of the latter,—*i. e.*, more than enough to saturate the bases present. This excess shows itself as free quartz. Thus it is not the percentage of silica in a rock-mass that carries it into the acid, neutral or basic class, but it is the lack or excess of silica as compared with the bases. Several empirical formulas represent the author's types. They are based on the determined ratio between bases and acid in neutral rocks, in which the amount of silica necessary to saturate the bases (in percentage) is represented by formula $\text{SiO}_2 = 2(\text{R}_2\text{O} + \text{RO}) + \text{R}_2\text{O}_3$. In neutral rocks this relation exists, consequently the formula represents the composition of such rocks. The amount of silica in basic rocks is represented by $\text{SiO}_2 = \text{R}_2\text{O} + \text{RO} + \text{R}_2\text{O}_3$, and in acid rocks $\text{SiO}_2 = 2(\text{R}_2\text{O} + \text{RO}) + \text{R}_2\text{O}_3 + \text{Quartz}$,—*i. e.*, the percentage of silica in these is greater than twice the sum of the percentages of R_2O and RO , plus R_2O_3 , by as much as there is quartz in the rock. The author then uses these formulas, with others deduced from them, as a basis for the classification of eruptives. His paper is interesting reading, and if facts justify his formulas the conclusions reached by the author will prove of value to petrographers.—Some recent discussions on the pressure alteration of basic eruptives have added quite a little to our information regarding this phenomenon. Welch ⁶ has described the alteration of diabases into schists in the region of the Soonwalde, in the Taunus, on the left side of the Rhine. Well-developed diabases exist near Rauenthal. Under the influence of pressure they have given rise to schistose rocks containing actinolite, and others in which chlorite and epidote have replaced the original augite. Other schists, whose relationship to diabase can be determined only by a microscopical examination, have been called hornblende-sericite-schists, augite-schists, and sericite-calc-phyllites. The author has made a careful study of all these, which has resulted in their separation into schists composed of actinolite and epidote, those containing a blue amphibole, and finally those made up principally of chlorite. In some of these derived rocks augite may still be detected, in others the diabase structure is still visible, while in a third class no traces of the original constituents nor of their arrangement are recognizable. All show evidence of pressure in the shapes of their components and in their nature. In the first class the epidote and chlorite have been derived from augite. The second class contains, in addition to glaucophane, a bluish-green actinolite, sericite, and biotite. Epidote is entirely wanting. The rocks of the third group are combinations of chlorite, quartz, sericite, and generally calcite. In each the structure is schis-

⁶ *Zeits. d. deuts. geol. Ges.*, XLI., 1890, p. 394.

tose, and the mother-rock was a diabase or a diabase-porphyrity. The paper concludes with a discussion of fifteen analyses of the rocks described.—Dynamically altered diabase and gabbros (sometimes schistose) occur also as sheets and dykes cutting altered sediments at St. Johnstown and Raphoe, in N. W. Ireland. Among them are epidiorites in which, according to Hyland,⁷ the hornblende still preserves the ophitic structure of the original augite. The original feldspar was labradorite, but the changes effected in it have yielded a quartz-feldspar-epidote mosaic in which the secondary feldspar is oligoclase.—The schists, granulites, and even some of the massive rocks of the Lizard, England, are distinctly banded. To account for the phenomenon it has been suggested that it is due either to original sedimentation, or to the deformation of eruptive rock-masses, or to the injection of rock material along planes of weakness in preëxisting rocks. Since the schists are now known to be eruptive, the first explanation is not available. Against the second Somervail⁸ brings the following objections, viz.: the symmetry of the banded structure, the frequent transitions between adjacent bands, and the uniform banding in large masses of the same composition. The injection theory is contradicted by the absence of irruptive contacts. He accounts for it on the supposition that segregations formed during the cooling of the magmas, yielding “schieren” that were afterwards squeezed.—A green schistose rock from near Zermatt, in the Pennine Alps, occurs so associated with other schists that Bonney⁹ is compelled to regard it as a pressure schist derived from serpentine. The rock is so very fissile that it may be split into sheets one-eighth of an inch thick. Only two essential constituents are observed in it, one an olive-green mineral, occurring in small translucent flakes with a cleavage like mica and an extinction parallel to this, and the other a chromite or magnetite. The former mineral may possibly be antigonite. Associated with this rock are two other schists: one, a green schist, is a soft chloritic rock, composed of chlorite, magnetite, and zoisite(?). The composition of the chlorite is probably near that of chloritoid. The other schist is full of talc. The origin of neither of these could be determined.—A suggestion in explanation of the cause of the transitions sometimes seen between crystalline and clastic rocks has recently been offered by Prof. Pumpelly,¹⁰ who believes that rock disintegration by weathering

⁷ *Geol. Magazine*, 1890, p. 205.

⁸ *Ib.*, Nov., 1890, p. 509.

⁹ *Ib.*, Dec., 1890, p. 533.

¹⁰ *Bull. Geol. Soc. Amer.*, Vol. II., p. 209.

has, in many cases, given rise to thick accumulations of loose material, which has subsequently been used in the manufacture of the detrital beds. If the new beds were laid down under the influence of gentle currents their basal member would contain a large proportion of the material of the older rocks, and would thus simulate them to a greater or less extent. If this explanation is found to hold good, it will obviate the supposed necessity of regarding granite and gneiss as derived from fragmental rocks by some form of obscure metamorphism.—Rosenbusch¹¹ attacks the subject of the origin of the schists from a chemical standpoint. He shows by citing analyses that some foliated rocks have compositions corresponding to those of massive rocks. These he regards as squeezed eruptives. Others are different in composition from any known eruptive. These he regards as dynamically changed sedimentaries. The foundation principle underlying the argument is that dynamo-metamorphism affects but little chemical change in the material upon which it acts, except such as may be brought about by percolating water.

Mineralogical News.—The unique mineral *melanophlogite* has been made the subject of recent study by Friedel¹² and by Streng.¹³ The former writer has examined the apparent cubes of the mineral in polarized light, and has found them to consist of six tetragonal pyramids, with their apices turned in and their bases forming the sides of the cubes. When heated the substance blackens and finally becomes opaque. Its density is 2.030–2.052, and the angle between contiguous cubic faces $91^{\circ} 23'$. The cubical cleavage reported by Lacroix does not exist. Some crystals appear to be simple cubes, while others are made up of many individuals, which in their section appear as fibers radiating from a center. They owe their form, consequently, not to pseudomorphism. They are pseudo-regular. A very careful analysis of these crystals yielded a result corresponding to $20\text{SiO}_2 + \text{SO}_3$, with small quantities of SrSO_4 and carbon. The crystals are implanted in opal. Other crystals, very similar to those described above, are the pseudomorphs of quartz described by Mallard. They have not the same density as melanophlogite, nor the same optical properties. The formation of the latter mineral is ascribed to the action of SO_3 on quartz. The author also describes fibrous crystals formed by the grouping of hexagonal lamellæ with most of the properties of the

¹¹ *Miner. u. Petrog. Mitth.*, XII., p. 49.

¹² *Bull. Soc. Franc. d. Min.*, XIII., 1890, p. 356.

¹³ *Ber. d. Oberhess. Ges. f. Naturw. und Heilk.*, 1890, p. 114. *Ref. Neues Jahrb. f. Min.*, etc., 1891, I., p. 18.

tetragonal melanophlogite. Analysis of these gave $\text{SiO}_2 = 93.2$ per cent., $\text{SO}_3 = 5.7$ per cent. This substance loses twelve per cent. of its weight on heating, while the tetragonal mineral loses six per cent. Streng declares that the mineral does not contain sulphuric acid, since it yields SO_3 only when treated with an oxidizing agent. Whether the sulphur is in the form of free sulphur or of an organic sulphide, could not be determined by him. The crystals, according to this author, are bounded by $\infty\text{O}\infty$ and $\infty\text{O}2$, and are probably pseudomorphs of opal and quartz after some unknown mineral.—A little more than a year ago the nodular rose-red *eudialite* of Magnet Cove, Arkansas, was described by Hidden and Mackintosh.¹⁴ Recently crystals of the substance have been investigated by Dr. J. F. Williams.¹⁵ These are tabular transparent or translucent rose-colored or crimson bodies traversed by cracks in all directions. They are hexagonal with $a : c = 1 : 2.1174$. OR, $\infty\text{P}2$, R, $-\frac{1}{2}\text{R}$, -2R appear on one crystal, and on another occur in addition $-\frac{3}{11}\text{R}$, $\frac{1}{4}\text{R}$, $\frac{1}{5}\text{R}$ and $-\frac{3}{4}\text{R}$.¹⁵ The density varies between 2.804 and 2.833, and the double refraction is positive. It is one of the youngest of the constituents of the eleolite-syenite in which it occurs. The negatively refracting *eucolite*, of about the same composition as eudialite, appears in brownish-yellow crystals in the same rock. In it a cleavage parallel to OR is quite pronounced. OR, R, $-\frac{1}{2}\text{R}$, ∞R , and $\infty\text{P}2$ bound its crystals. Its specific gravity is 2.6244–2.6630, and its hardness 5–5.5. He thinks it may be an altered eudialite.—The zinc-bearing *rhodonite* from Franklin and Sterling, N. J., has been reinvestigated by Pirsson.¹⁶ The crystals are usually tabular and elongated, parallel to ∞P . The new planes $2\text{P}\overline{\infty}$, $4\text{P}\overline{\infty}$ and $4\text{P}'$ were observed. The axial ratios, calculated from the best measurements obtained, are: $a : b : c = 1.078 : 1 : .6263$, $\alpha = 103^\circ 39'$, $\beta = 108^\circ 48' 30''$, $\gamma = 81^\circ 55'$. The cleavage is prismatic, and the extinction on the basal plane is 54° from the edge $\text{OP}\wedge\text{P}'$. Since the crystallographic constants and the extinction of the mineral differ so slightly from those of rhodonite, it seems that the morphotropic action of the zinc is but slight. Composition :

SiO_2	FeO	ZnO	MnO	CaO	MgO
46.06	3.63	7.33	34.28	7.04	1.30

corresponding to RSiO_3 .—Upon data collected during the course of many analyses of *uraninite* from American and foreign localities, Mr.

¹⁴ *Amer. Jour. Sci.*, XXXVIII., 1889, p. 494.

¹⁵ *Ib.*, Dec., 1890, p. 457.

¹⁶ *Ib.*, XL., Dec., 1890, p. 484.

Hillebrand¹⁷ concludes that nitrogen is a constant constituent of the mineral, and in a form different from any hitherto observed in the mineral kingdom; that its composition varies widely, and with it the physical characteristics; and, finally, that the composition does not correspond with any formula proposed to represent it. The author proposes to continue its study, and asks the aid of mineralogists in securing specimens.—Excellent transparent crystals of *anthophyllite* have been obtained by Mr. Penfield¹⁸ from Franklin, Macon county, N. C. They are prismatic with ∞P and ∞P_{∞} , but no terminations. The ratio $a : b$, based in approximate measurements, is .51375 : 1. The cleavage is perfect parallel to the prism and the brachypinacoid, and poor parallel to the macropinacoid, $2V_{na} = 88^{\circ} 46'$, with the corresponding index of refraction for $\beta = 1.6353$; $a = A$, $b = B$, $c = C$. The double refraction is negative for green and yellow light, and positive for red light. Density = 3.093. The composition is:

SiO ₂	FeO	MnO	MgO	CaO	H ₂ O	Al ₂ O ₃	Loss at 100°
57.98	10.39	.31	28.69	.20	1.67	63	.12

—The so-called *perowskite*¹⁹ from Magnet Cove, Ark., proves upon analysis to contain niobium and tantalum, and, therefore, to belong with dysanallyte, and not with perowskite. Its density is 4.18, and composition:

CaO	MgO	FeO	Fe ₂ O ₃	(Y.Er.Ta) ₂ O ₃	(CeLaDi) ₂ O ₃	Nb ₂ O ₅	Ta ₂ O ₅	TiO ₂	SiO ₂
33.22	.74	.23	6.16	5.42	.10	4.38	5.08	44.12	.08

—Some new facts with reference to the *beryls*, *bertrandites*, and *phenacites* from Mt. Antero, Col., are communicated by Penfield.²⁰ The crystals occur implanted in granite or on the feldspar and quartz of this rock. The beryl probably afforded the beryllium for the other two minerals. It occurs in light-green or blue prismatic crystals, usually simple combinations of P and OP , but occasionally also with $2P_2$ and $\infty P_{\frac{2}{3}}$. The peculiarity of the crystals is the number of depressions observed on various planes. These are pits bounded by pyramidal faces, and into them long needles of beryl project. The forms on the needles are $12P_{\frac{2}{3}}$, $12P_2$ and $2P$. The axial ratio of the *bertrandite* is .5993, instead of .5953, as printed in the author's first paper²¹ on the mineral. Some of the crystals of phenacite are inter-

¹⁷ *Ib.*, Nov., 1890, p. 384.

¹⁸ *Ib.*, Nov., 1890, p. 394.

¹⁹ *Ib.*, Nov., 1890, p. 403.

²⁰ *Ib.*, 1890, p. 488.

²¹ *Ib.*, XXXVI., 1888, p. 52.

penetration twins, with the base the twinning plane.—*Harmotome* is announced by Ferrier²² as occurring in calcite filling vuggs in veins cutting the Animikie slates in the vicinity of Rabbit Mountain, Ontario. Besides calcite, the minerals associated with the harmotome are amethyst, fluorite, and pyrite.—Black tin-bearing *rutile* crystals, supposed to be from the Harney Peak district, in the Black Hills, have a density of 5.294. Its composition, according to Headdn eand Pirsson,²³ is $\text{TiO}_2 = 90.79$; $\text{FeO} = 8.01$; $\text{SnO}_2 = 1.35$. The habit is orthorhombic, with $P\infty$, $\infty P\infty$ and P , twinned parallel to $11P\infty$.—Tin ore has not yet been found in workable deposits in Texas. Most of the material from that state reported as being cassiterite is keilhanite,²⁴ tourmaline, or black garnet.—Analyses of rhodochrosite from Franklin Furnace, N. J., yielded Browning,²⁵ after correcting impurities, the following figures:

MnO	CaO	ZnO	MgO	FeO	Fe ₂ O ₃	CO ₂	Sp. Gr.
45.55	11.41	1.48	1.78	.22	.16	39.40	3.47

Miscellaneous.—It is a pleasure to know that Messrs. Clarke and Schneider²⁶ are busy with experiments looking toward the settlement of problems relating to the constitution of natural silicates. The methods employed by them resemble somewhat those that have afforded such excellent results in organic chemistry. Silicates are exposed to the action of hydrochloric acid gas at high temperatures, and to its solution at ordinary temperatures, and the effects in each case are noted. They are then ignited and subjected to other reagents, and the products here obtained are compared with the results of the former experiments. In this way the presence of groups of elements is recognized that are analogous to the residues of carbon chemistry. The conclusion already arrived at by the authors are to the effect of *talc* is an acid metasilicate ($\text{Mg}_3\text{H}_2(\text{SiO}_3)_4$), and not a basic salt of pyrosilicic acid ($\text{Mg}(\text{Si}_2\text{O}_3)_2(\text{MgOH})_2$) as Groth suggests. *Serpentine* is thought be a substituted orthosilicate corresponding to $\text{Mg}_2(\text{SiO}_4)_2\text{H}_3(\text{MgOH})$, and its relation to olivine and chondrodite are represented as follows: Olivine = $\text{Mg}_4(\text{SiO}_4)_2$; chondrodite = $\text{Mg}_3(\text{MgF})(\text{SiO}_4)_2$; serpentine = $\text{Mg}_2(\text{MgOH})\text{H}_3(\text{SiO}_4)_2$. *Chlorite* is regarded as $\text{R}''_2(\text{SiO}_4)_2\text{R}'_4$, or olivine with half the magnesium replaced by R' , and the fluoriferous

²² Ib., Feb., 1891, p. 161.

²³ Ib., March, 1891, p. 249.

²⁴ Ib., March, 1891, p. 251.

²⁵ Ib., Nov., 1890, p. 375.

²⁶ Ib., 1890, XL., p. 312, 405.

phlogopite from Burgess, Ont., as $\text{Al}(\text{SiO}_4)_3\text{Mg}_3\text{KH}_2 + \text{Al}_2(\text{SiO}_4)_3\text{Mg}_2\text{K}$ (MgF).—Belowsky²⁷ finds that green hornblende, when subjected for some time to the heat of a bunsen burner, changes its color, the character of its pleochroism, the strength of its double refraction, and the position of its planes of extinction, and becomes in all respects similar to the basaltic variety. Upon the addition of a little sodium chloride²⁸ to a solution of sodium sulphate, the latter salt crystallizes upon evaporation as *thenardite*, and not as mirabilite. A mixture of potassium and sodium sulphate under the same conditions yield *glaserite*.—A few illustrations of regular growth of pyrite crystals are given by Smolar.²⁹ Some of the crystals (all of which are from Piedmont and Elba) are probably interpenetration twins according to some new law, while others are regular growth only. The author believes that our knowledge of twinned crystals is still in its infancy, and advises many more observations on regular intergrowths before we conclude as to the conditions of twinning. Rhombic pyramids of sulphur³⁰ crystallize from picoline or pyridine saturated with sulphuretted hydrogen.—The *oölitic iron ores* of the Clinton group in the Alleghenies are not cemented concretions, as was supposed, but they are pseudomorphs of bryozoons, or of fragments of these.³¹

ZOOLOGY.

Sipunculus gouldii.—Dr. E. A. Andrews, in a paper¹ that should have received earlier notice, describes the structure of this common east coast Sipunculid. The principal points brought out are the rich peripheral nervous system; the presence of “pseudostomata” in the splanchnic epithelium, the function of which remains unsettled; the division of the alimentary tract into several regions, differentiated by anatomical and histological peculiarities; the probability that the stomach is a sucking organ; the confirmation of the discovery that the reproductive organs were on the posterior surface of the origin of the posterior retractor muscles. Andrews thinks that the points which he has

²⁷ *Neues Jahrb. f. Min.*, etc., 1891, I., p. 291.

²⁸ Retgers. *Ib.*, 1891, I., p. 276.

²⁹ *Zeits. f. Kryst.*, XVIII., 1890, p. 475.

³⁰ Ahrens. *Ber. d. deutsch. chem. Ges.* XXIII., 1890, p. 2708.

³¹ *Amer. Journ. Sci.*, Jan., 1891, p. 28.

¹ Studies Biol. Lab. Johns Hopkins Univ., IV., p. 389, 1890.